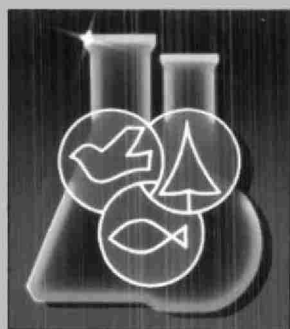


# **LABORATORY SERVICES BRANCH**

## **MINISTRY OF THE ENVIRONMENT**



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LABORATORY SERVICES BRANCH  
INVENTORY  
OF  
RESEARCH AND DEVELOPMENT ACTIVITIES  
(FISCAL YEAR 1987/1988)

ONTARIO MINISTRY OF THE ENVIRONMENT  
ENVIRONMENTAL SERVICES DIVISION  
LABORATORY SERVICES BRANCH  
125 RESOURCES ROAD  
REXDALE, ONTARIO  
M9W 5L1

NOVEMBER, 1987

A105



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## PREFACE

The inventory is a summary of the research and development projects being undertaken by the Laboratory Services Branch (LSB) in fiscal year 1987/88. The inventory provides a useful chronicle of the current analytical research and development activities of importance to the Laboratory Services Branch.

A brief description of 55 projects is provided. The projects are grouped according to the following four research categories:

- (1) LSB internal - research carried out in-house by the Branch.
- (2) LSB/University joint research venture - co-operative research studies between the Branch and the Universities, funded by the Branch.
- (3) LSB external - projects conducted outside (contract) the Ministry, funded by the Branch.
- (4) Research Advisory Committee (RAC) - projects undertaken outside the Ministry (grant, solicited or unsolicited contract) through funding provided by the RAC. Project liaison provided by Branch scientists.

The LSB analytical research program focuses primarily on projects necessary for maintaining a state-of-the-art laboratory, improving productivity, improving the accuracy and precision of data and expanding the range of test capabilities.

More detailed information may be obtained by contacting the principal scientist or supervisor responsible for the project.



G. C. Ronan, Director  
Laboratory Services Branch

**CHAPTER 1**

**LABORATORY SERVICES BRANCH**

**INTERNAL PROJECTS**

PROJECT NO.: DWO-I-87-01

PROJECT TITLE: Investigation of the use of the Aqueous Phase Liquid Extractor (APLE) for ultra trace organic sampling of water for determination of chlorinated dibenzo-p-dioxins/furans

OBJECTIVE(S): To develop rapid on-site methods of sampling and extraction of ultra-trace levels of organics, especially the chlorinated dibenzo-p-dioxins and furans.

PROJECT DESCRIPTION: The APLE sampler can extract up to 200 litres of water in the field in 1-2 hours using as little as 4 litres of solvent. Only the solvent needs to be transported back to the laboratory for analysis. Work will concentrate on analysis of chlorinated dioxins/furans in the particulate and aqueous components of pulp and paper effluents.

PROJECT START DATE: July, 1987

REPORTING DATE: January, 1988

PRINCIPAL INVESTIGATOR: Sharon Suter  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5895

CONTACT: Dr. Ray Clement  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5896

PROJECT NO.: DWO-I-87-02

PROJECT TITLE: Comparison of Mass Spectral Instrumental Capabilities (Low Resolution Mass Spectrometer-LRMS; High Resolution Mass Spectrometer-HRMS; Dual Mass Spectrometer-MSMS) for Chlorinated Dibenzo-p-dioxin and Dibenzofuran Determination

OBJECTIVE(S): To compare high resolution MS, low resolution MS (MSD Finnigan 4500) and MS-MS capability for Dioxin/Furan Determination.

PROJECT DESCRIPTION: Instrument detection limits, linear dynamic range, and freedom from interference for various sample types will be investigated. It is planned to define the degree of chemical work-up and type of instrumentation needed for special applications.

PROJECT START DATE: April, 1987

REPORTING DATE: March, 1988

PRINCIPAL INVESTIGATOR: Donna McCurvin  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5892

CONTACT: Dr. Ray Clement  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5896

PROJECT NO.: DWO-I-87-03

PROJECT TITLE: Stability Study of Chlorinated  
Dibenzo-p-dioxins and  
Dibenzofurans in Fish During  
Storage.

OBJECTIVE(S): To determine the effect of  
freezer storage time on  
analytical results.

PROJECT DESCRIPTION: Up to two years or more can  
elapse before ground fish samples  
are analyzed. This study is  
needed to determine whether the  
analytical results obtained are  
consistent over this time  
period.

PROJECT START DATE: January, 1987

REPORTING DATE: January, 1989

PRINCIPAL INVESTIGATOR: David Schellenberg  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5894

CONTACT: Brian Bobbie  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5890

PROJECT NO.: DWO-I-87-04

PROJECT TITLE: Automated Cleanup Method for  
Dioxins in Fish

OBJECTIVE(S): The study includes 2 phases:  
Phase I: Develop improved fish  
cleanup based on carbon  
adsorbents  
Phase II: Automate cleanup to  
allow overnight sample processing

PROJECT DESCRIPTION: I. Investigate the use of  
carbon fibre as adsorbents for  
the cleanup of fish tissue to  
improve recovery of dioxins and  
furans.

II. After the optimization of  
Phase I, the method will be  
automated by the use of robotics  
to allow increased sample  
throughput.

PROJECT START DATE: October, 1986

REPORTING DATE: June, 1988

PRINCIPAL INVESTIGATOR: Colleen Tashiro  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5895

Joan Crowther  
Laboratory Services Branch  
Water Quality Section  
235-5868

CONTACT: Dr. Ray Clement  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5896

PROJECT NO.: DWO-I-87-05

PROJECT TITLE: Method Development for the Determination of Chlorinated Dibenzo-p-dioxins and Dibenzofurans in Ambient Air.

OBJECTIVE(S): To develop a method for the determination of dioxins and furans in ambient air so that the transport of dioxins/furans in the atmosphere can be studied.

PROJECT DESCRIPTION: A method for the determination of dioxins in ambient air in cooperation with Air Resources Branch is being developed using polyurethane foam plugs in Hi-Vol samplers. High and low level spiked filters will be tested to determine recoveries and ambient air levels. Extraction method development is also necessary.

PROJECT START DATE: October, 1986

REPORTING DATE: June, 1988

PRINCIPAL INVESTIGATOR: Colleen Tashiro  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5897

Akos Szakolcai  
Air Resources Branch  
Emission Tech and Regulation  
Section  
965-1634

CONTACT: Dr. Ray Clement  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5896



PROJECT NO.: DWO-I-87-06

PROJECT TITLE: Investigation of Chlorinated  
Dibenzo-p-dioxins and Dibenzo-  
furans in Atmospheric Deposition

OBJECTIVE(S): A. To determine the  
presence/absence of dioxins/  
furans in toxic precipitation  
samples by collecting precipita-  
tion over an extended period and  
at various locations.

B. To determine if there are  
losses of dioxins/furans to the  
glass bottle walls during extend-  
ed storage periods.

PROJECT DESCRIPTION: A. Precipitation samples are  
collected for 28 day periods  
either directly or through an XAD  
cartridge. The samples are  
extracted, cleaned-up and  
analyzed by gas chromatography-  
mass spectrometry for dioxins/  
furans.

B. Dioxin spiked water samples  
are stored for varying periods of  
time, then extracted and analyzed  
to determine if wall losses of  
dioxins are occurring with extend-  
ed collection/storage periods.

PROJECT START DATE: November, 1986

REPORTING DATE: March, 1988

PRINCIPAL INVESTIGATOR: Colleen Tashiro  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5897

Maris Lusic  
Air Resources Branch  
Air Quality & Meteorology Section  
965-1634

CONTACT: Dr. Ray Clement  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5896

PROJECT NO.: DWO-I-87-07

PROJECT TITLE: Investigation of Volatiles  
Loss/ Degradation in  
Fish/Sediment During Storage

OBJECTIVE(S): To determine volatile  
organics loss in prepared fish  
tissue and sediment, stored at  
sub-0°C temperature over various  
time periods.

PROJECT DESCRIPTION: Fish will be prepared by  
present protocol. The blended  
tissue will be divided into  
sub-samples of approx. 10g. each  
and stored in glass vials (with  
teflon/silicone liners) at sub-  
0°C levels. At various time  
periods (i.e. 0 day, 1 day, 1  
week, 2 week, 3 week, 5 week, 10  
week), the tissue will be  
analyzed by purge + trap gas  
chromatography-mass spectrometry.  
The change in chromatographic  
fingerprint will be analyzed.

PROJECT START DATE: July, 1987

REPORTING DATE: August, 1988

PRINCIPAL INVESTIGATOR: Steve Jenkins  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5903

CONTACT: Dr. Vince Taguchi  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5902

PROJECT NO.: DWO-I-87-09

PROJECT TITLE: Development and Automation of a High Performance Liquid Chromatograph (HPLC) Method for the Analysis of PAH's in Drinking Waters.

OBJECTIVE(S): To develop and automate an HPLC method for the analysis of PAH's in drinking waters.

PROJECT DESCRIPTION: Development of extraction and automated HPLC analysis techniques for the analysis of 17 PAH's in drinking waters.

PROJECT START DATE: March, 1987

REPORTING DATE: December, 1987

PRINCIPAL INVESTIGATOR: Patrick W. Crozier  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5911

CONTACT: Dr. David Hall  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5910

PROJECT NO.: DWO-I-87-10

PROJECT TITLE: Feasibility Study for the  
Analysis of Toxaphene in Drinking  
Waters.

OBJECTIVE(S): To investigate the  
feasibility and if possible,  
implement methods for the  
analysis of toxaphene in drinking  
waters.

PROJECT DESCRIPTION: Development of extraction,  
clean-up and analysis methods for  
toxaphene in drinking waters,  
particularly methods of  
quantitation.

PROJECT START DATE: April, 1987

REPORTING DATE: March, 1988

PRINCIPAL INVESTIGATOR: Patrick W. Crozier  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5911

CONTACT: Dr. David Hall  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5910

PROJECT NO.: DWO-I-87-12

PROJECT TITLE: Identification of Unknown Organic Contaminants by High Resolution Mass Spectrometry (HRMS)

OBJECTIVE(S): To identify unknown organic environmental contaminants using high resolution mass spectrometric techniques.

PROJECT DESCRIPTION: Use advanced instrumentation (ZAB-2F) to identify organic environmental contaminants not analyzable by conventional low resolution mass spectrometric techniques. Sophisticated techniques including high resolution MS (accurate mass determinations), Mass spectrometer-Mass spectrometer (MS-MS), linked scanning and Mass Analyzed Ion Kinetic Spectrum (MIKES) will be employed.

PROJECT START DATE: March, 1987

REPORTING DATE: March, 1988

PRINCIPAL INVESTIGATOR: Dr. Eric Reiner,  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5903

CONTACT: Dr. Vince Taguchi  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5902

PROJECT NO.: TO-I-87-01

PROJECT TITLE: Chemical Characterization by  
Fourier Transform Infrared  
Spectroscopy (FT-IR).

OBJECTIVE(S): To adopt, develop and assess  
spectroscopy techniques in  
environmental pollution utilizing  
Fourier Transform Infrared  
Spectroscopy.

PROJECT DESCRIPTION: To adopt for routine use a  
recently purchased FT-IR  
Spectrophotometer and utilize the  
advantages of the new analytical  
system (higher speed, increased  
sensitivity, fast electronic data  
collection, data manipulation and  
storage). Implement FT-IR for  
characterization of waste samples  
and for litigation purposes.

PROJECT START DATE: May, 1987

REPORTING DATE: December, 1987

PRINCIPAL INVESTIGATOR: Mira Petranovic  
Laboratory Services Branch  
Trace Organics Section  
235-5758

George Wyhovszky  
Laboratory Services Branch  
Trace Organics Section  
235-5754

CONTACT: Joe Osborne  
Laboratory Services Branch  
Trace Organics Section  
235-5759

PROJECT NO.: TO-I-87-02

PROJECT TITLE: Diffuse Reflectance Infrared  
Fourier Transform Spectroscopy  
(Drift).

OBJECTIVE(S): To establish applications of  
a new optical sampling device  
capable of direct examination of  
solid powders.

PROJECT DESCRIPTION: The technique under  
investigation is expected to be a  
major time saver on sample  
preparation and will provide a  
major improvement of the  
analytical procedures identifying  
a wide range of solid materials.

PROJECT START DATE: May, 1987

REPORTING DATE: January, 1988

PRINCIPAL INVESTIGATOR: Mira Petranovic  
Laboratory Services Branch  
Trace Organics Section  
235-5758

George Wyhovszky  
Laboratory Services Branch  
Trace Organics Section  
235-5754

CONTACT: Joe Osborne  
Laboratory Services Branch  
Trace Organics Section  
235-5759

PROJECT NO.: TO-I-87-03

PROJECT TITLE: Introduction of Gas  
Chromatography Fourier Transform  
Infrared Spectroscopy (GC-FTIR)  
for Mixed Waste Analysis.

OBJECTIVE(S): To combine a powerful  
separation technique (GC) with a  
diagnostic analytical instrument  
(infrared) for identification of  
volatile organic compounds in  
mixed wastes.

PROJECT DESCRIPTION: To develop practical  
analytical methods for  
characterization and  
identification of major volatile  
organic compounds present in  
wastes from unknown sources.

PROJECT START DATE: August, 1987

REPORTING DATE: August, 1988

PRINCIPAL INVESTIGATOR: Mira Petranovic  
Laboratory Services Branch  
Trace Organics Section  
235-5758

George Wyhovszky  
Laboratory Services Branch  
Trace Organics Section  
235-5754

CONTACT: Joe Osborne  
Laboratory Services Branch  
Trace Organics Section  
235-5759



PROJECT NO.: TO-I-87-05

PROJECT TITLE: Evaluation of "TOX" Analyzer  
for on-site monitoring of  
Chlorinated Organics in  
Leachate.

OBJECTIVE(S):

1. Develop methodology for  
field applications.
2. Documentation of adequate  
QC/QA.

PROJECT DESCRIPTION: Project will entail  
evaluation/modification of the  
conventional "TOX" analyzer for  
mobile laboratory operations. If  
successful, unit will provide  
enhanced technical support for  
the monitoring of clean-up  
operations at contentious issue  
landfill and chemical spill  
sites.

PROJECT START DATE: April, 1987

REPORTING DATE: July, 1988

PRINCIPAL INVESTIGATOR: Dan Toner  
Laboratory Services Branch  
Trace Organics Section  
235-5759

CONTACT: Joe Osborne  
Laboratory Services Branch  
Trace Organics Section  
235-5759

PROJECT NO.: TO-I-87-06

PROJECT TITLE: Development and Evaluation of  
Micro Extraction/Clean-up  
techniques for Mobile Lab  
Implementation.

OBJECTIVE(S):

1. To adopt existing methodology for Mobile operations.
2. To investigate solid adsorbant extractants for field use.

PROJECT DESCRIPTION: To investigate the downsizing of conventional extraction and clean up technology for mobile laboratory operations. As well, project will investigate the use of solid adsorbants for field applications in groundwater analysis.

PROJECT START DATE: April, 1987

REPORTING DATE: July, 1988

PRINCIPAL INVESTIGATOR: Joe Osborne  
Laboratory Services Branch  
Trace Organics Section  
235-5759

CONTACT: Joe Osborne  
Laboratory Services Branch  
Trace Organics Section  
235-5759

PROJECT NO.: TO-I-87-07

PROJECT TITLE: Mass Selective Detector (MSD)  
for Mobile Laboratory Use.

OBJECTIVE(S): Provision of MSD capability  
for Mobile Laboratory  
Operations.

PROJECT DESCRIPTION: Installation and field  
evaluation of an MSD in a self  
contained mobile laboratory to be  
initiated during 1987/88. If  
successful, unit will provide  
enhanced and rapid field  
technical support.

PROJECT START DATE: April, 1987

REPORTING DATE: April, 1988

PRINCIPAL INVESTIGATOR: Dan Toner  
Laboratory Services Branch  
Trace Organics Section  
235-5759

CONTACT: Joe Osborne  
Laboratory Services Branch  
Trace Organics Section  
235-5759

PROJECT NO.: TO-I-87-08

PROJECT TITLE: Evaluation of Purge and Trap and Headspace Techniques for on-site analysis of volatile organics in groundwater.

OBJECTIVE(S):

1. Validation and Correlation of Analytical Techniques.
2. Field Implementation.
3. Improved Productivity.

PROJECT DESCRIPTION: To determine the correlation between purge and trap and headspace analytical techniques for use in the on-site analysis of volatile organics in groundwater/leachate, etc.

PROJECT START DATE: May, 1987

REPORTING DATE: December, 1987

PRINCIPAL INVESTIGATOR: Joe Osborne  
Laboratory Services Branch  
Trace Organics Section  
235-5759

CONTACT: Joe Osborne  
Laboratory Services Branch  
Trace Organics Section  
235-5759

PROJECT NO.: TO-I-87-09

PROJECT TITLE: Evaluation of Modified Hi-Vols  
for PAH Analysis

OBJECTIVE(S):

1. Method Validation
2. Implementation for Routine Operations
3. Provision of Accurate QA/QC Information

PROJECT DESCRIPTION: Standard Hi-Vol units were modified to accept an adsorbent field cartridge. The cartridges after exposure were extracted, cleaned up and analyzed for a range of PAH's to determine the effects of ozone removal and artifact formation.

PROJECT START DATE: June, 1986

REPORTING DATE: May, 1988

PRINCIPAL INVESTIGATOR: Steve Burns  
Laboratory Services Branch  
Trace Organics Section  
235-5758

Gerry Diamond  
Air Resources Branch  
Emission Tech and Regulation  
Development Section  
965-4081

CONTACT: Brian Foster  
Laboratory Services Branch  
Trace Organics Section  
235-6002

PROJECT NO.: TO-I-87-10

PROJECT TITLE: Measurement of Deposition of Organic Compounds due to Long Range Transport of Pollutants

OBJECTIVE(S):

1. Method Validation
2. Implementation for Routine Operations
3. Provision of QA/QC data
4. Paper/Report Presentation

PROJECT DESCRIPTION: Ambient air and precipitation samples will be taken at selected Great Lakes locations and analyzed for a range of chlorinated organics (PCB, DDT, Toxaphene), to determine the loading due to atmospheric deposition. Method will entail analysis in the sub ppt range.

PROJECT START DATE: July, 1986

REPORTING DATE: April, 1988

PRINCIPAL INVESTIGATOR:

Steve Burns  
Laboratory Services Branch  
Trace Organics Section  
235-5758

Maris Lusi  
Air Resources Branch  
Air Quality & Meteorology Section  
965-1634

CONTACT: Brian Foster  
Laboratory Services Branch  
Trace Organics Section  
235-6002

PROJECT NO.: TO-I-87-12

PROJECT TITLE: Broad Range Screening Method  
for Phenol Speciation

OBJECTIVE(S): To provide a gas  
chromatographic analytical method  
for the analyses of a broad range  
of phenols, catechols, guaicol  
found in the Pulp and Paper  
Industry effluents.

PROJECT DESCRIPTION: Method consists of dual  
FID/EC method to simultaneously  
analyze chlorinated and  
non-chlorinated speciated  
phenols. After a preliminary  
extraction and derivatization,  
the extracts are submitted to gas  
chromatography.

PROJECT START DATE: December, 1985

REPORTING DATE: To be determined

PRINCIPAL INVESTIGATOR: Roxana Lega  
Laboratory Services Branch  
Trace Organics Section  
235-5756

CONTACT: Yvonne Jones  
Laboratory Services Branch  
Trace Organics Section  
235-5760

PROJECT NO.: TO-I-87-13

PROJECT TITLE: Routine Method for Analysis of  
Resin and Fatty Acids for the  
Paper & Pulp Industry

OBJECTIVE(S): To provide a routine method  
for the analysis of resin and  
fatty acids, targeting on the  
parameters required for MISA  
Paper and Pulp Industry.

PROJECT DESCRIPTION: A method provided by Dr. Voss  
from Paprican will be adjusted  
and developed to provide a  
routine method for the analysis  
of fatty and resin acids in MOE  
labs, using the presently  
available automated G.C. - auto  
samplers, tumblers etc. with the  
requested client detection  
limits.

PROJECT START DATE: March, 1987

REPORTING DATE: March, 1988

PRINCIPAL INVESTIGATOR: Roxana Lega  
Laboratory Services Branch  
Trace Organics Section  
235-5756

CONTACT: Yvonne Jones  
Laboratory Services Branch  
Trace Organics Section  
235-5760



PROJECT NO.: WQ-I-87-01

PROJECT TITLE: Robotics for Dissolved Oxygen Measurement in the Biochemical Oxygen Demand Test (BOD Test)

OBJECTIVE(S): To automate the measurements of oxygen concentration required on the first and fifth day of the BOD test.

PROJECT DESCRIPTION: Purchase robotic hardware and software to enable unattended oxygen readings and data collection. Occasional attention will be required to change sample bottles in racks. The major difficulty is minimizing the time for each reading since more than 600 readings may be required per day.

PROJECT START DATE: March, 1987

REPORTING DATE: December, 1987

PRINCIPAL INVESTIGATOR: Walter Wright  
Laboratory Services Branch  
Water Quality Section  
235-5879

Ben Cheung  
Laboratory Services Branch  
Water Quality Section  
235-5874

CONTACT: Peter Campbell  
Laboratory Services Branch  
Water Quality Section  
235-5872

PROJECT NO.: WQ-I-87-02

PROJECT TITLE: Robotics for Weight Measurement  
in the Solids Test

OBJECTIVE(S): To automate the measurement  
of weights of filters and dishes  
containing dried residue from  
environmental samples. Initial  
tare weight measurement is also  
to be automated.

PROJECT DESCRIPTION Purchase robotic hardware and  
software to enable unattended  
weighing on microbalance, and  
data collection. Occasional  
attention will be required to  
change racks of filters or  
dishes. The major difficulty is  
minimizing the time required for  
each reading, since more than  
2,000 readings may be required  
per week.

PROJECT START DATE: March, 1987

REPORTING DATE: December, 1988

PRINCIPAL INVESTIGATOR: Walter Wright  
Laboratory Services Branch  
Water Quality Section  
235-5879

John Evans  
Laboratory Services Branch  
Water Quality Section  
235-5878

CONTACT: Peter Campbell  
Laboratory Services Branch  
Water Quality Section  
235-5872

PROJECT NO.: WQ-I-87-03

PROJECT TITLE: Development of 15 Methods for Technicon TRAAC Colourimetric Systems

OBJECTIVE(S): To develop 15 colourimetric methods using the latest hardware and state-of-the-art techniques for continuous flow systems.

PROJECT DESCRIPTION The reagent concentrations, time, and mixing parameters from the existing AutoAnalyzer II methods will be recalculated to suit the TRAACS 800 hydraulics. A suitable manifold will be built and tested. Several runs of samples over several days will be intercompared.

PROJECT START DATE: April, 1987

REPORTING DATE: December, 1988

PRINCIPAL INVESTIGATOR: Mike Rawlings  
Laboratory Services Branch  
Water Quality Section  
235-5880

CONTACT: Mike Rawlings  
Laboratory Services Branch  
Water Quality Section  
235-5880

PROJECT NO.: WQ-I-87-04

PROJECT TITLE: Robotics for Sub-Aliquoting  
Station for Inorganic Tests

OBJECTIVE(S): To prepare multiple aliquots  
of samples which are suitable for  
Water Quality Section work  
stations and which are  
accompanied by identifiers  
suitable for LIS operations.

PROJECT DESCRIPTION Based on an initial  
feasibility study by an outside  
consultant, a design for a  
robotic station will be  
developed.

PROJECT START DATE: September, 1987

REPORTING DATE: April, 1989

PRINCIPAL INVESTIGATOR: Walter Wright  
Laboratory Services Branch  
Water Quality Section  
235-5879

CONTACT: Walter Wright  
Laboratory Services Branch  
Water Quality Section  
235-5879

PROJECT NO.: ITC-I-87-01

PROJECT TITLE: Tracer Studies Using ICP/MS  
Isotope Ratios: Air Particulate

OBJECTIVE(S): To investigate the  
feasibility of using isotope  
ratios to identify and  
discriminate various sources of  
pollution.

PROJECT DESCRIPTION A method has been developed  
for the analysis of air  
particulate. Pb206/207 ratios  
have been measured in a group of  
samples from Dorset, Ontario.  
The isotope ratios correlate with  
air mass trajectories.

PROJECT START DATE: April, 1986

REPORTING DATE: October, 1987

PRINCIPAL INVESTIGATOR: Dave Boomer  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5858

Len Barrie  
AES  
Federal Government  
667-4785

CONTACT: Dave Boomer  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5858

PROJECT NO.: ITC-I-87-02

PROJECT TITLE: Determination of Arsenic,  
Selenium and Antimony in  
Environmental Matrices by Flow  
Injection Analyzer (FIA)-Hydride  
Flameless Atomic Absorption  
Spectrophotometric (FAAS)  
Techniques

OBJECTIVE(S): To develop a routine semi-  
automated method for the  
determination of arsenic,  
selenium and antimony at ultra-  
trace concentrations in  
environmental samples.

PROJECT DESCRIPTION The object is to develop a  
fast routine method for the  
determination of arsenic,  
selenium, and antimony in  
environmental matrices by  
interfacing FIA with the Hydride  
FAAS. Low detection limits will  
be achieved and will assist the  
client groups in establishing  
background levels of the above  
elements.

PROJECT START DATE: June, 1987

REPORTING DATE: September, 1988

PRINCIPAL INVESTIGATOR: Ram Sadana  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5861

CONTACT: Ram Sadana  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5861

PROJECT NO.: ITC-I-87-03

PROJECT TITLE: The Application of Robotics for  
the Digestion of Fish Samples for  
Mercury Analysis

OBJECTIVE(S): To develop an automated fish  
digestion procedure by using  
robotics.

PROJECT DESCRIPTION To develop an automated  
sample digestion procedure for  
biomaterials using robotics. It  
will shorten turnaround time for  
mercury analyses, thus achieving  
higher productivity.

PROJECT START DATE: June, 1987

REPORTING DATE: April, 1988

PRINCIPAL INVESTIGATOR: Ram Sadana  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5861

Bob Hillier  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5845

CONTACT: Ram Sadana  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5861

PROJECT NO.: ITC-I-87-07

PROJECT TITLE: Microwave Digestion of  
Vegetation and Soil Samples

OBJECTIVE(S): To develop a routine sample  
preparation method using a  
microwave oven to replace present  
ashing, acid extraction system.

PROJECT DESCRIPTION A microwave system for  
digesting both soil and  
vegetation matrices will be  
developed. Results of analysis  
of samples for heavy metals must  
match present method in accuracy  
and precision. QA/QC protocols  
will be established and a report  
produced. Time savings should  
result.

PROJECT START DATE: November, 1986

REPORTING DATE: May, 1988

PRINCIPAL INVESTIGATOR: Liz Pastorek  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5855

CONTACT: Liz Pastorek  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5855



PROJECT NO.: ITC-I-87-08

PROJECT TITLE: Application of Robotics to  
Digestion of Vegetation and Soil  
Samples for Analysis of Metals

OBJECTIVE(S): To apply a robotic system to  
a microwave digestion technique  
used for vegetation and soil  
sample preparation for metal  
analysis.

PROJECT DESCRIPTION A robotic system will be set  
up to interact with a microwave  
oven by weighing samples,  
dispensing acids, placing samples  
into and taking them out of the  
oven. The computer will register  
sample weights for calculation of  
final concentration of metals  
present. Time savings should  
result.

PROJECT START DATE: May, 1987

REPORTING DATE: April, 1988

PRINCIPAL INVESTIGATOR: Liz Pastorek  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5855

CONTACT: Liz Pastorek  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5855

PROJECT NO.: ITC-I-87-11

PROJECT TITLE: ICP/MS Development of Method  
for Analysis of Drinking Water  
for Elements

OBJECTIVE(S): To develop a sensitive  
accurate method for the direct  
analysis of drinking water for  
elemental composition.

PROJECT DESCRIPTION Instrumental parameters have  
been optimized. Matrix effects  
have been investigated and  
minimized. Computer programs  
have been written to process the  
data. Intercomparisons and spike  
studies are being completed.  
Further development will extend  
the range of application to  
surface water.

PROJECT START DATE: May, 1986

REPORTING DATE: November, 1987

PRINCIPAL INVESTIGATOR: Dave Boomer  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5858

CONTACT: Dave Boomer  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5858

PROJECT NO.: ITC-I-87-12

PROJECT TITLE: Development of New Low Volume Sampling System using Teflon Filters for Trace Metals Analysis of Air Samples by X-Ray Fluorescence (XRF) Spectrometry

OBJECTIVE(S): Current revisions to regulation 308 will require the Ministry to be able to analyze for a wider range of inorganic parameters on air filters. This project will develop and evaluate teflon filter media for collection of air samples to be analyzed for trace metals by X-Ray and for TSP thus improving efficiency & throughput of analysis in support of air quality monitoring programs.

PROJECT DESCRIPTION Project activities include:

- 1) choice & establishment of sampling stations for purposes of comparison of systems;
- 2) development of analytical method for XRF;
- 3) analysis of samples by current methods including atomic absorption spectrophotometry (AAS) and ion chromatography (IC);
- 4) statistical analysis of data;
- 5) establishment of QA/QC protocols.

PROJECT START DATE: To be determined

REPORTING DATE: --

PRINCIPAL INVESTIGATOR: Jerry Hipfner  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5856

Rusty Moody  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5863

CONTACT: Jerry Hipfner  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5856

PROJECT NO.: ITC-I-87-14

PROJECT TITLE: Development of Methods for the Determination of Electroactive Species such as  $\text{CN}^-$ ,  $\text{S}^=$ , by Ion Chromatography

OBJECTIVE(S): To develop working methods for the determination of electroactive species such as  $\text{CN}^-$  and  $\text{S}^=$  in environmental samples by ion chromatography.

PROJECT DESCRIPTION Published techniques for the determination of electroactive species such as  $\text{CN}^-$  and  $\text{S}^=$  by electrochemical detection and ion chromatography will be rigorously investigated to develop working methods for these two ions in particular. The investigation will include a study of all flow and separation parameters such as pH and eluant composition as well as optimum reduction voltages.

PROJECT START DATE: June, 1987

REPORTING DATE: May, 1988

PRINCIPAL INVESTIGATOR: Jerry Hipfner  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5856

CONTACT: Jerry Hipfner  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5856

## **CHAPTER 2**

**LABORATORY SERVICES BRANCH - UNIVERSITY**

**JOINT RESEARCH VENTURE PROJECTS**

PROJECT NO.: TO-E-87-01

PROJECT TITLE: Investigation and Development  
of Supercritical Fluid Extraction  
(SCF) of Trace Organics from  
Environmental Matrices.

OBJECTIVE(S): To develop reliable and rapid  
methods for extraction of trace  
organics from environmental  
matrices using supercritical  
fluids.

PROJECT DESCRIPTION Supercritical fluids will be  
used to extract, possibly  
selectively, organics (e.g.  
PAH's) from environmental  
matrices. The supercritical  
extraction stage will be followed  
by conventional analytical  
methods to determine extraction  
efficiency.

PROJECT START DATE: November, 1987

REPORTING DATE: March, 1990

PRINCIPAL INVESTIGATOR: Dr. Wightman  
Carleton University

CONTACT: Ian Carter  
Laboratory Services Branch  
Trace Organics Section  
235-5757

PROJECT NO.: ITC-E-87-02

PROJECT TITLE: ICP/MS Analytical Development

OBJECTIVE(S): To investigate the analytical capabilities of the ICP/MS with emphasis on environmental analysis.

PROJECT DESCRIPTION Various aspects of the instrumentation will be investigated and developed. Project items include optimization of analytical conditions using simplex techniques, investigation of negative ion capability for determination of negative ions (sulfur and halogens) and application to tracer analysis and source allocation in precipitation samples; and optical, ICP/MS interface to determine added elements.

PROJECT START DATE: January 1987

REPORTING DATE: March, 1990

PRINCIPAL INVESTIGATOR: Dr. B. McNutt  
McMaster University

LIAISON OFFICER/CONTACT: Dave Boomer  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5858

**CHAPTER 3**

**LABORATORY SERVICES BRANCH**

**EXTERNAL PROJECTS**



PROJECT NO.: DWO-E-87-03

PROJECT TITLE: Method Development for Aqueous Volatile Halocarbons Analysis at the Parts Per Trillion Level

OBJECTIVE(S): To develop methodology for the quantitative routine analysis of ambient water for volatile halocarbon compounds in the low parts per trillion (w/w) range.

PROJECT DESCRIPTION This method is to be developed with the Perkin-Elmer ATD-50 and its associated gas chromatograph equipped with an electron capture detector.

The lower detection limits will improve determination of the mobility of these compounds, the dilution effect, the distribution of these compounds within industrial discharge plumes and the plume size several hundred metres, and more, downstream from the source.

PROJECT START DATE: June, 1987

REPORTING DATE: October, 1987

PRINCIPAL INVESTIGATOR: Cecelia Chan  
Mann Testing Laboratories Limited  
890-2555

LIAISON OFFICER/CONTACT: O. William Berg  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5907

**CHAPTER 4**

**RESEARCH ADVISORY COMMITTEE**

**PROJECTS**

PROJECT NO.: 170PL

PROJECT TITLE: Syntheses of Oxygen and Sulphur  
PAHs of Interest in Environmental  
Pollution and Toxicology.

OBJECTIVE(S): To prepare polynuclear  
aromatic hydrocarbon compounds  
for use as chemical standards in  
the analysis of air particulate  
matter.

PROJECT DESCRIPTION: A method will be developed  
for the preparation of PAH furans  
and related hazardous compounds.  
The method will be extended to  
the preparation of thiophenes and  
other chemicals suspected in  
emission sources from coal,  
municipal incineration and diesel  
engines.

PROJECT START DATE: August, 1984

REPORTING DATE: March, 1988

PRINCIPAL INVESTIGATOR: E. Lee-Ruff,  
Department of Chemistry  
York University

LIAISON OFFICER/CONTACT: Otto Meresz  
Laboratory Services Branch  
Trace Organics Section  
235-5762

PROJECT NO.: 200RR

PROJECT TITLE: PAH Analysis of Environmental Samples at Low Temperature using Fluorescence Detection.

OBJECTIVE(S): Establish applicability of PAH analysis of environmental samples by low Temperature Fluorescence Spectroscopy, and to examine the utility of Shpol'skii Spectroscopy for computer based data acquisition and processing in order to identify a selected group of PAH compounds, will be examined.

PROJECT DESCRIPTION: Environmental samples will be examined after the different preparatory stages currently required for analysis. Shpol'skii Spectroscopy using narrow spectralband lasers as an excitation source will be used to identify a selected group of carcinogenic PAHs. Additionally, the suitability of Shpol'skii Spectroscopy for computer based data acquisition and processing in order to identify a selected group of PAH compounds, will be examined.

PROJECT START DATE: April, 1985

REPORTING DATE: March, 1988

PRINCIPAL INVESTIGATOR: S.V. Filseth, F.J. Morgan and C. M. Sadowski  
Faculty of Science  
York University

LIAISON OFFICER/CONTACT: George Crawford  
Laboratory Services Branch  
Trace Organics Section  
235-5757

PROJECT NO.: 207RR

PROJECT TITLE: Screening Methods for Air and Water Samples: Application of Inductively Coupled Plasma Mass Spectrometry (ICP/MS) to Elemental Analysis.

OBJECTIVE(S):

1. To develop ICP/MS methods for multi element analyses of solid and liquid environmental materials.
2. To develop ICP/MS as detector for liquid and gas chromatography columns to determine the chemical form of metals.
3. To extend above to include isotopic ratio studies.
4. To verify the developed methods.

PROJECT DESCRIPTION: An electrothermal atomizer will be developed for direct sample introduction into the ICP/Mass Spectroscopy System. The developed methods for the analyses of gas or liquid chromatographic effluents would allow for the determination of the chemical form of toxic metals in air and water samples. The methods will further be extended to allow for the determination of isotopic ratios. The developed methods and technologies will be transferred for use in MOE laboratory.

PROJECT START DATE: June, 1985

REPORTING DATE: March, 1988

PRINCIPAL INVESTIGATOR: J.B. French (UTIAS) and Jon C. Vanloon (IES)  
University of Toronto

LIAISON OFFICER/CONTACT: Dave Boomer  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5858

PROJECT NO.: 230PL

PROJECT TITLE: Development of an Ultrasonic Nebulizer for Stable and Reproductive Production of Aerosols for Atomic Spectrometric Analysis.

OBJECTIVE(S):

1. To develop an inexpensive but reliable ultrasonic nebulizer system.
2. To evaluate this device using AAs, ICPAES and ICPMS\*.
3. To transfer the technology to MOE.

\* AAS-Atomic absorption spectrometry; ICPMS-Inductively coupled plasma mass spectrometry; ICPAES-Inductively coupled plasma atomic emission spectrometry.

PROJECT DESCRIPTION: A transducer/power supply system from a \$100 home ultrasonic humidifier has been used. The power supply has been modified for stability and proper impedance matching. Use of a coating directly on the transducer plate surface (compared to a bonded plate) is being investigated.

PROJECT START DATE: October, 1985

REPORTING DATE: March, 1988

PRINCIPAL INVESTIGATOR: Jon C. Van Loon  
Institute of Environmental Studies  
University of Toronto

LIAISON OFFICER/CONTACT: Dave Boomer  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5858

PROJECT NO.: 246RR

PROJECT TITLE: Study of the Thermal Reactions of Polychlorinated Dibenzo-p-Dioxins on Flyash Particles under Incinerator Conditions.

OBJECTIVE(S): Incinerator flyash will be placed in a heated flowtube. Nitrogen will be passed through the flyash to an impinger /florisil combination which will absorb any organic compounds volatilized from the flyash. Some suspected precursors of chlorinated dioxins and dibenzofurans will be introduced into the gas stream above the flyash. The flyash, flowtube, impinger and florisil will be analyzed for dioxins and furans after each experiment. The temperature range of 100 C to 600 C will be investigated.

PROJECT DESCRIPTION: 1. Establish the thermal behaviour of chlorinated dioxins and dibenzofurans on flyash particles under incinerator conditions.

2. Identify precursors and establish mechanisms of dioxin formation on flyash particles.

PROJECT START DATE: April, 1986

REPORTING DATE: March, 1988

PRINCIPAL INVESTIGATOR: F.W. Karasek  
Professor of Chemistry  
University of Waterloo

LIAISON OFFICER/CONTACT: Ray Clement  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5890

PROJECT NO.: 270RR

PROJECT TITLE: Development and Evaluation of Methods and Instrumentation for the Direct Analysis of Solids by Inductively Coupled Plasma Atomic Emission Spectrometry.

OBJECTIVE(S): The development of instrumentation and methodologies which will allow the direct analysis of solid and difficult liquid samples.

PROJECT DESCRIPTION: Inductively coupled plasma atomic emission optical detection methods will be used for multi elemental analysis. Furnace and direct sample insertion methods will be evaluated.

PROJECT START DATE: September, 1986

REPORTING DATE: March, 1989

PRINCIPAL INVESTIGATOR: Professor Eric Salin  
Department of Chemistry  
McGill University

LIAISON OFFICER/CONTACT: Dave Boomer  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5858



PROJECT NO.: 274PL

PROJECT TITLE: Characterization of the Fecal Indicator Bacterial Flora of Sanitary Sewage with Application of Identify the Presence of Sanitary Waste in Storm Sewers.

OBJECTIVE(S):

1. To determine the concentration of fecal indicator bacteria in storm water and storm sewers at selected Toronto locations;
2. To identify the species present in the above bacterial population;
3. To conduct the above analysis on sanitary sewers serving the same areas;
4. To develop a method to determine the presence of sanitary waste in storm sewers;
5. To apply the above procedure to the tracing of illegal sanitary connections to priority storm sewers in the Metro Toronto area.

PROJECT DESCRIPTION

Samples will be collected from selected sites and analyzed for various types of fecal forms. The wastewater is then characterized. The obtained information will improve Ministry ability to identify the presence of human fecal waste in intermediate sample types such as storm sewers, and would assist in making corrective measures.

PROJECT START DATE: September, 1986

REPORTING DATE: March, 1989

PRINCIPAL INVESTIGATOR: Professor P. Seyfried  
Department of Microbiology  
University of Toronto

LIAISON OFFICER/CONTACT: Mike Young  
Laboratory Services Branch  
Water Quality Section  
235-5866

PROJECT NO.: 276PL

PROJECT TITLE: Klebsiella Pneumoniae Membrane Filtration Procedure.

OBJECTIVE(S):

1. Development of a protocol for the enumeration of Klebsiella pneumoniae from environmental samples;
2. Determination of the ability of experimental methods to isolate Kp. sensu stricto;
3. Assessment and documentation of the performance characteristics of the method of choice.

PROJECT DESCRIPTION

Samples isolated from a variety of environmental materials will be analyzed by membrane filtration. Ten isolates will be obtained from each medium/sample combination. Methods with best specificity and selectivity will have their counting range and accuracy determined. A final report will be prepared detailing and evaluating all results and indicating the method of choice.

PROJECT START DATE: September, 1986

REPORTING DATE: March, 1988

PRINCIPAL INVESTIGATOR: Professor P. Seyfried  
Department of Microbiology  
University of Toronto

LIAISON OFFICER/CONTACT: Mike Young  
Laboratory Services Branch  
Water Quality Section  
235-5866

PROJECT NO.: 287PL

PROJECT TITLE: Field Trials of Developed DNA Probes for Determining Bacterial Pollution Source Inputs.

OBJECTIVE(S): To determine the specificity in field trials of developed DNA probes (human, goose, gull) to trace and quantitate the sources of pollution at the Toronto Harbour Front.

PROJECT DESCRIPTION Isolates obtained from MOE Microbiology section laboratory, (Contact, Mr. Mike Young) which have been collected from human, animal and bird feces will be analyzed in a 'Blind' study by the DNA probes. The latter results will be compared with standard biochemical identifications. The DNA analyzed samples will then subsequently be sent back to the MOE microbiology laboratory for 'Blind' confirmation.

PROJECT START DATE: October, 1986

REPORTING DATE: March, 1988

PRINCIPAL INVESTIGATOR: Dr. W.C. Bradbury  
Toronto General Hospital  
University of Toronto

LIAISON OFFICER/CONTACT: Mike Young  
Laboratory Services Branch  
Water Quality Section  
235-5866

PROJECT NO.: 288PL

PROJECT TITLE: Development and Critical Evaluation of a Dual Column Gas Chromatography Method for the Determination of Polycyclic Aromatic Compounds in Environmental Samples.

OBJECTIVES: The development of a dual-column gas chromatography method for the routine analysis of polycyclic aromatic compounds in environmental samples, using retention indices and either general or selective detectors. The general detectors being a flame ionization (FID) or photo-ionization detector (PID) and the selective detectors being an electron capture (ECD) or a thermionic sensitive detector (TSD). In order to have an efficient protocol, a data base of GC retention indices for various polycyclic compounds will also be produced. Once the method has been developed the degree of confidence associated with the method will be obtained through a critical comparison of its data with that of GC/MS (gas chromatography/mass spectrometry) LC/DAD (liquid chromatography with a UV-VIS diode array detector) and LC/MS. (liquid chromatography/mass spectrometry).

PROJECT DESCRIPTION The chemical composition of environmental samples such as airborne particulates and sediments is very complex, consisting of hundreds of inorganic and organic components. A very important class of compounds in such samples are the polycyclic aromatic hydrocarbons and their derivatives. This project will attempt to develop and evaluate a routine dual-column GC method for the analysis of polycyclic aromatic compounds (PAC) and create a data base of retention indices for PAC identification.

PROJECT START DATE: October, 1986

REPORTING DATE: March, 1988

PRINCIPAL INVESTIGATOR: M.A. Quilliam  
Department of Chemistry  
McMaster University

LIAISON OFFICER/CONTACT: Joe Osborne  
Laboratory Services Branch  
Trace Organics Section  
235-5759

PROJECT NO.: 290PL

PROJECT TITLE: Nature of Substrates in Industrial Wastes Relative to Elemental Leachability.

OBJECTIVE(S): The overall objective of the study is to use the characterization of the solid phases of industrial wastes to determine their metal leachability and hence to be able to specify the environmental conditions required for stabilization and disposal.

PROJECT DESCRIPTION: 1. Characterization of the solid phases of wastes by X-ray diffraction, electron microscopy, selective extraction, surface area;  
2. Determination of kinetics of metal leachability in wastes;  
3. Protocol development for classification of industrial wastes based upon their toxic metal stability which is based upon their solid phases.

PROJECT START DATE: October, 1986

REPORTING DATE: March, 1990

PRINCIPAL INVESTIGATOR: J.R. Kramer  
Department of Geology  
McMaster University

LIAISON OFFICER/CONTACT: Jim Pimenta  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5854

PROJECT NO.: 304PL

PROJECT TITLE: Provision of Isomerically Pure Nitro-PAH Analytical Standards.

OBJECTIVE(S):

1. To prepare, by short and efficient routes, several classes of nitro-PAHs, potent direct acting mutagens which are increasingly detected in the environment from a variety of sources. Nitro-PAHs to be prepared are a variety of isomers of: nitro-fluorenes, nitrofluoranthenes, nitrophenanthrenes, and nitro benz(a)anthracenes.
2. Similarly, to prepare a series of hydroxylated derivative of the above classes of nitro-PAHs of interest as metabolites and products of atmospheric photochemical and chemical oxidation. Some of these have already been detected in air particulate extract.

PROJECT DESCRIPTION:

The work is based on recent synthetic methodology developed in the researcher's laboratories using transition metal catalyzed cross coupling reaction between arylboronic acids and aryl halides. It will allow the preparation of up to 100 mg quantities of a number of highly pure nitro-PAHs and nitro-hydroxy-PAHs in short time and with minimum handling of potentially toxic intermediates. Analytical purities will be established by HPLC, NMR, HPLC-MS, and GC-MS techniques. Once preparation methods are standardized, the work will be funded by the user Branch.

PROJECT START DATE: March, 1987

REPORTING DATE: March, 1990

PRINCIPAL INVESTIGATOR: V. Snieckus  
The Guelph-Waterloo Centre for Graduate Work in Chemistry  
University of Waterloo

LIAISON OFFICER/CONTACT: Otto Meresz  
Laboratory Services Branch  
Trace Organics Section  
235-5762

PROJECT NO.: 323PL

PROJECT TITLE: Development of Liquid Crystal Capillary Columns for Analysis of Polychlorinated Dioxins and Furans by GC/MS

OBJECTIVE(S): Under this project, work will be undertaken to develop the selective liquid crystal phases and fabricate capillary columns for separation of PCDDs, PCDFs and PAHs in environmental mixtures.

PROJECT DESCRIPTION: A direct analysis of environmental samples by GC/MS needs selective capillary columns. Liquid crystals are the selective stationary phases that have shown high selectivity for separation of various structural isomers, polyaromatic compounds (PAC) and 2,3,7,8-tetrachlorodibenzo-p-dioxin, that is not possible using the conventional capillary columns. However, such polymeric liquid crystal capillary columns are not readily available. Liquid crystalline polymer stationary phases having polysiloxane and polyacrylate backbones with liquid crystalline moieties as side chains will be developed for capillary columns. The selectivity of such columns will be determined using standard isomeric mixtures that are impossible to separate on conventional capillary columns. The correlation between the structure of liquid crystalline polymer and its selectivity will be established. The newly developed columns will be applied to the analysis of environmental samples.

PROJECT START DATE: April, 1987

REPORTING DATE: March, 1988

PRINCIPAL INVESTIGATOR: Professor F.W. Karasek  
Professor of Chemistry  
University of Waterloo

LIAISON OFFICER/CONTACT: Ray Clement  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5896

PROJECT NO.: 324PL

PROJECT TITLE: Procedure for the 2,3,7,8-Substituted Analysis of PCDD, PCDF and other Target Compounds in Environmental Samples.

OBJECTIVE(S): The present method of analysis of PCDD and PCDF does not provide sufficient separation of the most toxic isomers of these compounds. This proposal will utilize a two-step high performance liquid chromatographic fractionation to replace the present multi-step liquid chromatographic procedure. Once the method has been optimized to separate quantitatively the 2,3,7,8-substituted isomers it will also provide simultaneous determination of a wide variety of other organic pollutants.

PROJECT DESCRIPTION: The two-step HPLC fractionation procedure developed for project 210 PL will be rigorously optimized and tested for the analysis of the 2,3,7,8-substituted PCDD and PCDF in a variety of samples supplied by MOE. A large number of samples will be studied in order to optimize the fractionation procedure for the routine analysis of target compounds including PCDD, PCDF, PCB, pesticides, and polycyclic aromatic hydrocarbons (PAH). Ultimately the HPLC method will be designed such that it will be amenable to automated analysis. Upon finalization of the method, MOE will receive a working HPLC and their staff will be trained to complete the technology transfer of the HPLC procedure. Criteria will be established for the identification and determination of 2,3,7,8-TCDD, 2,3,7,9-TCDF, and various other target compounds found in the samples analyzed.

PROJECT START DATE: April, 1987

REPORTING DATE: March, 1988

PRINCIPAL INVESTIGATOR: F.W. Karasek  
Professor of Chemistry  
University of Waterloo

LIAISON OFFICER/CONTACT: Ms. Colleen Tashiro  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5897



PROJECT NO.: 325PL

PROJECT TITLE: Preparation of Heterocyclic Polynuclear Aromatic Hydrocarbons for Analytical Standards.

OBJECTIVE(S): To prepare specific thiophene and carbazole PAH's that are related to mutagenic carbocyclic analogues for reference standards in environmental analysis. Once these compounds are synthesized the second portion of the project will be to monitor the fate of these compounds under simulated environmental oxidations, providing information on their relative stability.

PROJECT DESCRIPTION: The synthesis of the compounds are based on two independent methods involving cyclobutanones and arylmethyl cations substituted by a thiocarbonyl group which were developed by the investigator. The preparation of the triophenes is based on the latter whereas the carbazole preparation is based on the former route. Furthermore, the synthesized thiophenes will be subjected to controlled simulated environmental conditions. This will involve primarily self-sensitized photooxidation studies.

PROJECT START DATE: April, 1987

REPORTING DATE: March, 1989

PRINCIPAL INVESTIGATOR: Professor E. Lee Ruff  
Department of Chemistry  
York University

LIAISON OFFICER/CONTACT: Joe Osborne  
Laboratory Services Branch  
Trace Organics Section  
235-5759

PROJECT NO.: 326PL

PROJECT TITLE: An Expert System for Quality Assurance in Analytical Chemistry.

OBJECTIVE(S): The development of a generic expert system for use as a quality control and quality assurance program in the analytical laboratory. The study will involve the design and implementation of a prototype system software.

PROJECT DESCRIPTION: Designing prototype expert systems software: designing rule and knowledge databases structure; designing user interface; designing a general instrument communication interface. Designing instrumental analysis quality control programs. Implementation of the expert system designs. Development of AAS data model and elucidation of human expertise for AAS.

PROJECT START DATE: April, 1987

REPORTING DATE: March, 1988

PRINCIPAL INVESTIGATOR: Professor Martin J. Stillman  
Department of Chemistry  
University of Western Ontario

LIAISON OFFICER/CONTACT: Jerry Hipfner  
Laboratory Services Branch  
Inorganic Trace Contaminants  
235-5856

PROJECT NO.: 327PL

PROJECT TITLE: Solid-supported Isolation and Derivatization - An Approach to Automation of Environmental Organic Analysis.

OBJECTIVE(S): The development of a technique utilizing a XAD-Z resin for an adsorbent as well as a support for analytical derivatization of organic compounds.

PROJECT DESCRIPTION: These objectives will be met through a systematic study of the variables to the reaction on the scale required for environmental analysis. They will be part of on-going studies on the chemistry of solid supported reactions on XAD-2 and other non-ionic macroreticular resins and application of this class of new reagents to analytical problems. The major focus of application will be the eventual development of robotics as a flexible analytical tool capable of addressing a majority of analytical requirements.

PROJECT START DATE: April, 1987

REPORTING DATE: March, 1989

PRINCIPAL INVESTIGATOR: Dr. J.M. Rosenfeld  
Associate Professor  
McMaster University

LIAISON OFFICER/CONTACT: Dave Hall  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5910

PROJECT NO.: 328PL

PROJECT TITLE: Detection and Quantification of Herbicides in Soil, Water and Plant Extracts using an Enzyme Linked Immunosorbent ASSAY (ELISA)

OBJECTIVE(S): The development of an enzyme linked immunosorbent assay (ELISA) for the detection of trace levels of herbicides in soil, water and plants.

PROJECT DESCRIPTION: Detection of pesticides has been based mainly on conventional techniques such as gas-liquid chromatograph, HPLC, and thin-layer chromatography. Although these techniques are sensitive and reproducible, they are tedious, time consuming, and extremely expensive. In fields of clinical chemistry and endocrinology, immunochemistry is often the analytical method of choice because of its sensitivity, specificity, speed of analysis, ease of automation, cost effectiveness, and general applicability. The ELISA technique is a promising alternative because it shares many of the advantages of the radioimmunoassay, and it has the additional advantage of requiring only inexpensive equipment and of being well adapted to automated or partially automated methods.

PROJECT START DATE: January, 1987

PROJECT REPORTING DATE: March, 1989

PRINCIPAL INVESTIGATOR: Dr. J.C. Hall  
Environmental Biology  
University of Guelph

LIAISON OFFICER/CONTACT: Pat Crozier  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5911

PROJECT NO.: 329PL

PROJECT TITLE: Refinement and Testing of a  
Preconcentration Sampler for  
Dioxins in Water.

OBJECTIVE(S): To develop an automated  
preconcentration water sampler  
for the analysis of raw/treated  
water for chlorinated dioxins and  
dibenzofurans, and to deliver to  
MOE a final, tested prototype  
suitable for field work.

PROJECT DESCRIPTION This is a one year project to  
complement design and operation  
modifications identified in the  
completed initial trials.  
Specifically, capacity and  
convenience of operation of  
filter systems will be improved;  
duplication of adsorption streams  
will be implemented with improved  
adsorption column designs;  
surrogate spike chemicals will be  
tested with improved spiking  
apparatus.

PROJECT START DATE: April, 1987

PROJECT REPORTING DATE: March, 1988

PRINCIPAL INVESTIGATOR: Bryan R. Hollebone  
Professor of Chemistry  
Carleton University

LIAISON OFFICER/CONTACT: Helle Tosine  
Laboratory Services Branch  
Drinking Water Organics Section  
235-5906



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